



Corrosion Assessment Guidance for Higher Strength Pipelines Project 153H

2nd QUARTERLY PUBLIC REPORT

Period: July through September 2005

Background

Metal loss due to localized corrosion and pitting of pipelines can significantly increase the risk of rupture. Therefore, it is vitally important to accurately determine the residual strength of corroded pipelines so that proper remedial actions may be taken to avoid catastrophic events. Although historical methods and practices for inspection and integrity assessment have led to an overall safe and reliable pipeline infrastructure with a low frequency of failures, public expectations concerning pipeline safety are growing, and industry is committed to pursuing further improvements. Consequently, new US regulations and sophisticated inspection technologies have burdened many operators with large quantities of data that are often difficult to interpret and apply within the framework of existing assessment guidelines. Clearly, the industry needs a technically sound, comprehensive and integrated approach to assess and mitigate the effects of localized corrosion in gas and oil pipelines, and to assure appropriate pressure-containment safety margins.

Several methods have been developed for assessment of corrosion defects, such as ASME B31G, RSTRENG and LPC. These methods were developed using an early fracture mechanics relationship for toughness-independent failure of pressurized pipes and were empirically calibrated against a database of full-scale burst tests for thin wall pipes. Some work has already been done to address the limitations of existing assessment methods available to the industry. The objective of this project is to extend these methods by providing guidance for assessing corrosion damage in high strength steels up to X100. Following completion of these tasks, new rules and guidance for comprehensive assessment of corrosion damage in transmission pipelines will be incorporated into a Guidance Document for use by the pipeline industry.

Summary of Progress this Quarter

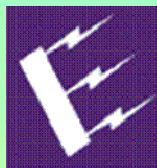
Stress versus strain data for grade X80 and X100 pipeline material was sourced from public domain sources, including from recent ASME International Pipeline Conference papers and related Pipeline Research Council International (PRCI) Materials Technical Committee funded projects. Round bar tensile test results have been obtained for:

- ◆ 36" diameter grade X80 parent material
- ◆ 48" diameter grade X80 parent material
- ◆ 36" diameter grade X100 parent material

In each case the yield and ultimate tensile strength was confirmed to meet specified minimum values. All materials data has been converted into true stress versus true strain form as required for non-linear finite element analysis.

Finite element analysis was carried out and failure predictions were made for axially orientated groove like defects in 36" and 48" diameter X80 material and 36" diameter X100 material. Sensitivity of failure pressure to defect depth and length has been investigated.

**Consolidated
Research and
Development
Program to
Assess the
Structural
Significance of
Pipeline
Corrosion**



ELECTRICORE
POWERING THE FUTURE



Contact

Ian Wood

Program Manager

Electricore, Inc.

Office: 661-607-0261

Fax: 661-607-0264

ian@electricore.org

www.electricore.org

Results

Results from the round bar tensile test for 36" and 48" diameter grade X80, and 36" diameter grade X100 material are presented in Table 1 below. All materials data has been converted into true stress versus true strain form as required for non-linear finite element analysis.

Model Dimensions			Material Grade	Defect Geometry								
OD (D) (in/mm)	wt (t) (in/mm)	D/t		Type	Depth (d)	Length (L)						
36 / 914.4	0.5 / 12.7	72	X65	Axial groove	0.2t	✓	✓	✓	✓	✓	✓	✓
					0.5t	✓	✓	✓	✓	✓	✓	✓
					0.8t	✓	✓	✓	✓	✓	✓	✓
36 / 914.4	0.5 / 12.7	72	X80	Axial groove	0.2t	✓	✓	✓	✓	✓	✓	✓
					0.5t	✓	✓	✓	✓	✓	✓	✓
					0.8t	✓	✓	✓	✓	✓	✓	✓
36 / 914.4	0.5 / 12.7	72	X100	Axial groove	0.2t	✓	✓	✓	✓	✓	✓	✓
					0.5t	✓	✓	✓	✓	✓	✓	✓
					0.8t	✓	✓	✓	✓	✓	✓	✓
48 / 1219	0.626 / 15.9	76.7	X65	Axial groove	0.2t	✓	✓	✓	✓	✓	✓	✓
					0.5t	✓	✓	✓	✓	✓	✓	✓
					0.8t	✓	✓	✓	✓	✓	✓	✓
48 / 1219	0.626 / 15.9	76.7	X80	Axial groove	0.2t	✓	✓	✓	✓	✓	✓	✓
					0.5t	✓	✓	✓	✓	✓	✓	✓
					0.8t	✓	✓	✓	✓	✓	✓	✓

Table 1: Matrix of pipe geometry and materials to be assessed

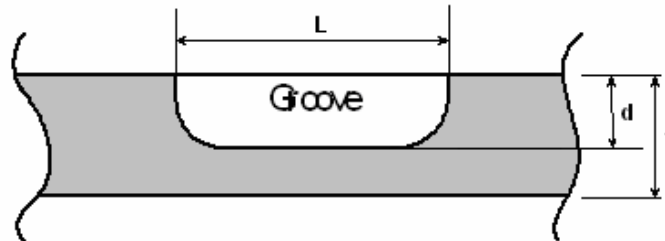
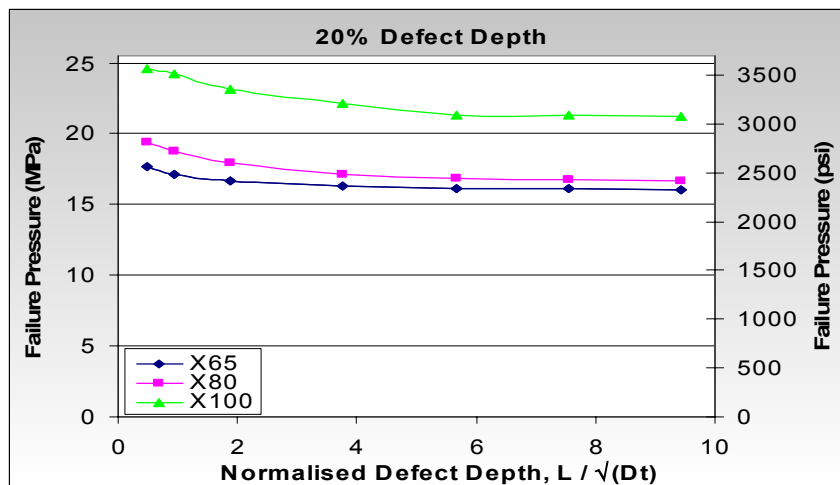


Figure 1: Diagram of material cross section showing Defect Geometry measurements

Figure 2 below shows an example of the calculated failure pressure versus defect length for 36" diameter pipe of grade X65, X80 and X100.



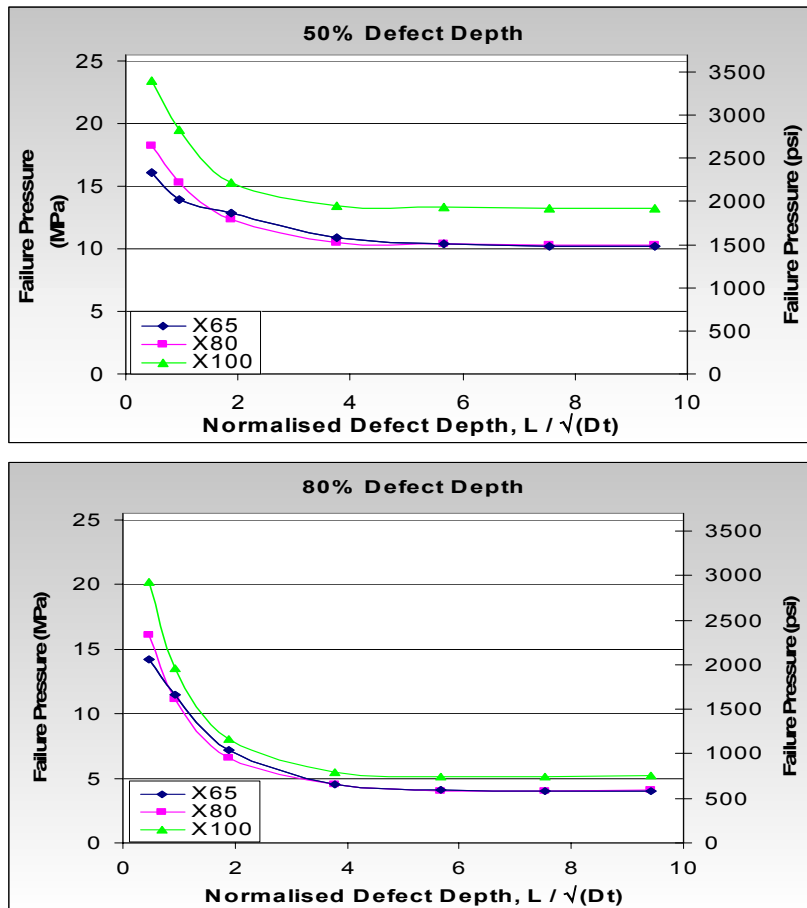


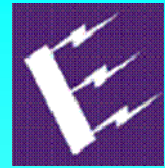
Figure 2: 36in x 12.7mm Models – Example Failure Pressure versus Normalized Defect Length for Varying Defect Depths

Future Activities

Work over the next two quarters will focus on conducting the finite element analysis of the selected materials to determine the failure behavior.

Partners in Success

- ♦ Electricore, Inc. www.electricore.org
- ♦ Pipeline Research Council International, Inc. (PRCI) www.prci.org
- ♦ Advantica, Inc. www.advantica.biz



ELECTRICORE
POWERING THE FUTURE



Principal Investigator

Vinod Chauhan

Advantica, Inc.

Office: +44 (0)1509 282363

Fax: +44 (0)1509 283119

vinod.chauhan@advantica.biz

